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A PSYCHOLOGICAL BASIS FOR THE DIAGNOSIS OF FEEBLE-MINDEDNESS.

RUDOLF PINTNER AND DONALD G. PATERSON.¹

A real study of the feeble-minded and a clear differentiation of this group from the demented, the psychopathic and other allied groups is of comparatively recent date. In the growth of this study we may note a gradual change in viewpoint from the more strictly medical aspect, which regarded idiocy and imbecility rather in the light of a disease entity, to the psychological aspect, in which the lack of intelligence is the main difference between the feeble-minded and the normal. So that at the present time feeble-mindedness is looked upon almost entirely as representing merely a difference in the amount of intelligence possessed by the feeble-minded individual as contrasted with the normal individual, and the medical point of view, though by no means subordinate, is relegated to those cases where a specific disease may be the cause of the lack of development of intelligence. These cases are much less common than was previously supposed, since it is now recognized that the vast majority of feeble-minded individuals are those that have not developed normally from birth. This change in viewpoint is due to the great progress made by psychology in the measurement of intelligence. The psychology of individual differences, and the psychology of tests is enabling us more and more accurately to measure differences in intelligence among individuals, and we are now for the most part basing our diagnosis of feeble-mindedness upon the results of tests.

If this is so, it seems well to discuss the basis upon which our tests of differences in intelligence rest. What right have we to call an individual feeble-minded as a result of intelligence tests? The usual answer to this is that if the individual tests two, three or four years backward, as the case may be, on some intelligence scale, or if he fails to reach a certain age level or degree of intellectual development, he is to be regarded as feeble-minded. This is taken to be a sufficient diagnosis by many investigators. Others, desiring to assume a more cautious and conservative stand, will always qualify the above by insisting that other tests in addition to the usual scales must be taken into account, and hinting that there are other criteria besides tests. Characteristic of this position is the following

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quotation,² "A mental age of 10 or above is not necessarily indicative of feeble-mindedness, regardless of how old the examinee may be, and a young child may test almost at age and yet be feeble-minded as determined by other criteria." Search for these other tests and other criteria often proves futile or results in unearthing some test, that has been very inadequately, if at all, standardized, upon which the investigator pins much faith, although the significance of any specific performance of the test seems much less than that of the performance of the well standardized tests included in the scales. If the fallacy of this position is pointed out, there is still another position to which the conservative worker may retreat and in which he remains well entrenched, and this is his knowledge of the feeble-minded as a class, the experience he has accumulated in associating with them and in studying them in their daily lives. The value of such experience is, of course, inestimable, but it is questionable whether judgments based upon it can ever supplant the more accurate measurements of intelligence as derived from psychological tests. Such experience can never lead to the finer differentiations of grades of intelligence, nor is it often by itself of much account when a diagnosis has to be arrived at quickly. Furthermore, it is to be noted, that it is the result of experience gained among a group of individuals that has already been diagnosed as feeble-minded by other workers in the first place and since opinions as to feeble-mindedness, particularly of the so-called higher grades, differ somewhat in different institutions, we may very well conceive of different concepts of feeble-mindedness being arrived at according to the type of institution in which the individual may have acquired his experience.

All these methods of diagnosis are based upon empirical knowledge of a group of individuals which we have come to call feeble-minded. Before we had any psychological tests, an individual was diagnosed as an idiot or imbecile because he resembled others who had been so designated previously. After the advent of the psychological scale we found by empirical means that two or three or four years retardation existed in individuals who resembled the group of individuals that society had been designating feeble-minded. The empiricism of this procedure is clear from the shifting opinions in regard to the amount of retardation necessary before a valid diagnosis of feeble-mindedness could be made. To take the Binet-Simon scale as an example, we find at first that a retardation of three years is said to be

²Informal Conference on the Binet-Simon Scale: Some Suggestions and Recommendations. J. of Ed. Psych. Vol. V, 1914, p. 95.

diagnostic of feeble-mindedness.³ Later we are told that below the age of nine, two years retardation is indicative of feeble-mindedness, and above that age, three years. Then again some workers would diagnose as feeble-minded those three years retarded below the age of nine and four years retarded above nine. The dividing line between feeble-mindedness and normality for older children and adults has been variously placed at 12, 11 or 10. All these changes mean that we have been trying to fit the scale to the actual existing conditions. We have a vague notion of what is meant by a feeble-minded individual and in order to use our scales for diagnostic purposes we have been finding out what those who are ordinarily termed feeble-minded accomplish on the scale and employing these results in turn to diagnose new cases. This is, of course, entirely natural and necessary in our search for a more definite concept of feeble-mindedness and a more definite means for measuring the same.

Is it the only way? It seems to us that we can at this stage approach the subject from another viewpoint, and that we are now ready for a more definite psychological concept of feeble-mindedness based upon the underlying theory of the measurement of intelligence. The underlying hypothesis is that, given a sufficiently large number of individuals, they will distribute themselves in regard to degrees of intelligence upon a normal curve. The larger the number of individuals, the closer will their distribution conform to a normal distribution. Assuming this hypothesis to be correct, it is our purpose here to see what results will follow in applying it to the classification of individuals according to the degree of their intelligence. At the very outset the assumption of such a hypothesis gives us an excellent means for deciding upon certain groups of individuals. We may adopt a three-, four-, five- or n-fold classification according to the accuracy of our measuring rod. At the present time a five-fold classification would seem the most feasible, because we already differentiate between the feeble-minded, backward, normal and supernormal. To these there ought to be added a fifth group at the upper end of our distribution corresponding in size to the lowest group of feeble-minded. Just what the percentages of these groups should be is, of course, purely arbitrary, but we may make certain assumptions, i. e., that fifty per cent lie in the middle or normal group and twenty-five per cent above and twenty-five per cent below, and that these two groups of twenty-five per cent again may each be divided into a larger and a smaller group containing twenty-two per cent and three per cent

³Goddard, H. H. Discussion on a paper by Kuhlmann. *J. of Psycho-Asthenics*. Vol. XVI, 1912, p. 192.

respectively. We would then have a distribution of people on the basis of their intellectual ability as is indicated on the normal curve in Figure 1.

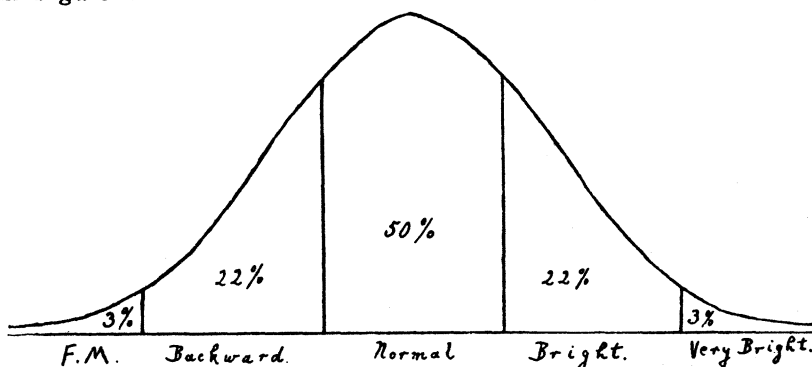


FIG. 1

The distribution of the cases above the normal does not interest us at present, since we have made little progress in measuring mentality at the upper end of the curve. The composition of the normal, backward and feeble-minded groups is, however, more definite, and the time seems ripe to insist upon a clearer differentiation of these groups. Whether the actual percentages attributed to each group is justifiable or not will be discussed shortly, at any rate the advantage of a definite meaning attached to the terms feeble-minded, backward and normal must be obvious at once. It will get rid of the anomaly of defining feeble-mindedness in sociological terms and diagnosing it by psychological and not sociological criteria.^{3a} For the definition of feeble-mindedness as generally accepted is "a state of mental defect existing from birth or from an early age and due to incomplete or abnormal development in consequence of which the person affected is incapable of performing his duties as a member of society in the position of life to which he was born." As Davenport⁴ remarks, "It follows at once as a corollary that feeble-mindedness is not a biological, but a social term." And we may add that it also follows that it is not a psychological term as so defined. According to the above definition it cannot denote any specific mental level. We would be forced to have different standards for different communities and for different sections of each community, as Yerkes⁵ desires, and if we push on

^{3a}Since writing this article Kuhlmann's excellent discussion bearing upon this topic has come to the author's notice. Kuhlmann F.—"What Constitutes Feeble-Mindedness?" *Journal of Psycho-asthenics*. Vol. 19, No. 4, June, 1915, p. 214-236.

⁴Davenport, C. B. Review of Goddard's *Feeble-mindedness: Its Causes and Consequences*. *Science*. 10 December, 1915. N. S. Vol. XLII, No. 1093.

⁵Yerkes, Bridges and Harwick. *A Point Scale for Measuring Mental Ability*. Warwick and York, Baltimore, 1915, p. 75 *et seq.*

to the logical conclusion we are in danger of arriving at the case of an individual born and reared in a degenerate community being considered normal simply because he can perform adequately his duties as a member of that community, and being considered feeble-minded as soon as he steps out of his immediate environment.⁶

A psychological definition of feeble-mindedness has in reality been growing up. We find this in the statements made by various workers at various times in reference to a specific amount of retardation measured by mental tests. At times a very positive opinion has been expressed that all children testing three or more years backward and not exceeding twelve years on the Binet-Simon scale are to be classed as feeble-minded. This view has not been subscribed to by all workers and various modifications have been suggested. A rigid application of this standard would raise the percentage of feeble-mindedness above any figure that has ever been suggested. We have never seen this standard applied to large numbers of so-called normal children. An adherence to this high standard seems to account for the very high percentages of feeble-mindedness that have been given in some studies on delinquents. Nevertheless, if this standard had been agreed to by all, some of the confusion that has resulted from the introduction of other standards might have been avoided, but even then such a psychological definition of feeble-mindedness would have been unsatisfactory. It is not only arbitrary in the extreme, but it rests upon no general principle. It defines feeble-mindedness in terms of success or failure in the performance of certain tests, almost with the presumption that certain specific tests are infallible. Such an arbitrary standard cannot hope to be universally adopted. The results that would follow from it will be shown in actual statistics below.

It is in order to avoid this vagueness and uncertainty attaching to the term that we suggest a definite psychological concept. The lowest three per cent of the community at large, that is, the lowest as determined by definitely standardized mental tests, are to be called feeble-minded. Such a definition will be unambiguous and the dividing line between this and other groups will become clearer and clearer as we increase the accuracy of our measuring scales and the adequacy of our standardizations. Furthermore, if evolution is raising the degree of intelligence the three per cent at the lower end will still remain, for, whatever the degree of their intelligence may be, they will still be feeble-minded as compared with the normal.

⁶Terman, Lewis M. *et al.* The Stanford Revision of the Binet-Simon Scale. *J. of Ed. Psych.* Vol. VI, 1915, p. 560.

Such a definition will in addition restrict the term to such as are lacking in intelligence and will differentiate them from the moral defectives and the psychopathic personalities, which are at present often confused with the group that we propose to call feeble-minded. An individual may be at the same time a moral defective and feeble-minded, but there is reason to believe that moral deficiency may exist without such intellectual defect as to warrant a diagnosis of feeble-mindedness. The same may be said of the psychopathic personality.

The further question, whether all those coming within the proposed definition of feeble-mindedness are to be confined in institutions, is purely social and will be determined by the social needs of each community and does not concern us here. It is obvious that many more in addition to the feeble-minded as defined by us will require the restraint of an institution, even although no real mental defect exists.

It is immaterial for the purposes of this hypothesis whether three or a smaller or larger percentage be designated as feeble-minded. The important point is the agreement upon some fixed percentage, and we have chosen three per cent as covering presumably all the cases of marked mental deficiency. A brief glance at the chief estimates of the number of feeble-minded in civilized communities would indicate that our percentage is somewhat higher than the conservative writers give, but we shall show later on that it is much lower than the results obtained from groups of children tested by intelligence scales.

In 1898 Ireland⁷ came to the conclusion after going over the then available statistics for many countries that there is one feeble-minded to every 500 of the population. The Royal Commission on the Care and Control of the Feeble-minded⁸ increased this estimate to .46 per cent. The work of this commission was the first and only attempt to obtain an estimate of feeble-mindedness over a whole country. It is frankly a conservative estimate, and this is borne out by the fact that many authorities testifying before the commission gave higher percentages of feeble-mindedness for different groups of the community than the commission ultimately arrives at in its final summary.

Later estimates of feeble-mindedness for other countries besides Great Britain seem all more or less traceable to the conclusions of

⁷Ireland, W. W. *The Mental Affections of Children*. First Edition, Edinburgh. 1898. Second Edition, London, 1900, p. 3ff.

⁸Report of the Royal Commission on the Care and Control of the Feeble-minded, etc. London, 1905-8.

the commission. Such, for example, is Fernald's⁹ estimate of "probably two to 1,000 of our population," and this same estimate is given by Newmayer.¹⁰ When we come to estimates of feeble-mindedness among the school population alone there seems to be a general tendency to go a little higher than the figures quoted above. Goddard¹¹ arrives at an estimate of two to three per cent. Shuttleworth and Potts¹² give the number of feeble-minded among the school children of Switzerland as 1.5 per cent.

If now we turn abruptly from these estimates to actual results found by the application of the Binet-Simon scale, we are surprised at the much larger percentages arrived at. To quote Wallin¹³ "Goddard's figures show 8.4 per cent three or more years retarded. Counting below nine two years retardation as feeble-minded, there are 10.4 per cent, assuming one fifth of Goddard's cases are below age nine." Irwin¹⁴ in a New York west side school finds 15.92 per cent feeble-minded. Woolley¹⁵ finds 26 per cent of 50 eighteen year old working girls mentally defective according to the Yerkes scale. Taking Goddard's (Note 11 *ante*) 1,413 cases as being the largest number tested and published up to date in a manner adequate to be reviewed in detail, we find the following percentages of feeble-mindedness at the various ages, applying the three year retardation above age nine and the two year below age nine, and secondly the four and three year retardation basis. These percentages are shown in Table I.

TABLE I.
SHOWING THE PERCENTAGES OF FEEBLE-MINDED AT EACH AGE, CONSTRUCTED FROM GODDARD'S DATA, DIAGNOSING AS F. M. 1, ON 3 AND 2 BASIS,
I. E., 3 YEARS RETARDATION ABOVE 9 AND 2 YEARS BELOW;
2, ON 4 AND 3 BASIS, I. E., 4 YEARS RETARDATION ABOVE

Age	9 AND 3 YEARS BELOW. 3 and 2 Basis		4 and 3 Basis	
	No.	Per Cent.	No.	Per Cent.
5	6	5.3	2	1.8
6	4	2.5	1	0.6
7	11	5.6	3	1.5
8	5	2.4	4	1.9
9	0	0	0	0
10	18	8.1	3	1.3
11	18	10.8	5	3.0
12	27	18.7	14	9.7
Total	89	6.3	32	2.3

⁹Fernald, W. E. The Burden of the Feeble-minded. J. of Psycho-Asthenics. 1912, p. 87.

¹⁰Newmayer, S. W. Medical and Sanitary Inspection of Schools. Lea and Febiger, Philadelphia, 1913, p. 251.

¹¹Goddard, H. H. Two Thousand Normal Children Measured by the Binet Measuring Scale of Intelligence. Ped. Sem. Vol. 18, 1911, p. 232.

¹²Shuttleworth and Potts. Mentally Deficient Children. London, 1910, p. 17.

¹³Wallin, J. Wallace. The Mental Health of the School Child. Yale University Press, 1914, p. 449.

¹⁴Irwin, Elizabeth A. A Study of the Feeble-minded in a West Side School, in New York City. Training School Bulletin. Vol. X, 1913, p. 65.

¹⁵Woolley, H. T. A New Scale of Mental and Physical Measurements for Adolescents. J. of Ed. Psych. Vol. VI, 1915, p. 528.

The discrepancy between the estimates and the results of actual tests is obvious and it is for this reason, among others, that it seems desirable to adopt a uniform percentage. Assuming the three per cent basis we may turn to the results of tests that are available and discover the diagnostic value of our scale. The assumption is that there are three per cent feeble-minded at each age, since the distribution at each age is likely to conform to the distribution of all ages combined. Although the mortality among the feeble-minded may be somewhat higher than among the normal, there is no reason to suppose that the discrepancy will be such as to make any vital difference in the shape of our ideal curve of distribution.

To bring out the difficulties of the "fixed amount of retardation" method of diagnosis, we have summed up all the results available of tests of normal children where the publications have shown the distribution for each age. This summary is shown in Table II and the figures used in this table are made up of the combined results of the following workers:

NAME.	No. of Cases.
Strong	225
Brigham	294
Phillips	57
Rogers and McIntyre.....	217
Berry	45
Goddard	1,536
Binet and Simon.....	192
Dougherty	519
Terman	396
Bobertag	261
Descoeurdes	24
Decroly and Degand.....	44
Kuhlmann	619
Total.....	4,429

Table II shows the actual numbers at each age distributed according to the number of years advanced or retarded.

TABLE II.
COMPOSITE TABLE, SHOWING THE DISTRIBUTION OF MENTAL AGES FOR EACH
CHRONOLOGICAL AGE. ACTUAL NUMBERS.

Age	+4	+3	+2	+1	0	-1	-2	-3	-4	-5	-6	Total
3	2	3	3	4	.....	.....	.....	.....	.....	12
4	2	28	14	13	5	1	.....	.....	.....	.....	63
5	6	37	112	84	18	5	2	.....	.....	.....	264
6	3	2	28	150	161	51	4	.....	1	.....	.....	400
7	1	6	22	165	312	39	14	2	1	.....	.....	562
8	17	33	101	289	144	5	2	2	.....	.....	593
9	5	20	133	250	124	35	1	.....	.....	.....	568
10	4	18	77	284	104	51	21	3	.....	.....	562
11	1	3	45	215	144	64	21	6	1	.....	500
12	4	146	163	94	37	14	4	.....	462
13	12	76	93	78	16	7	1	283
14	1	.....	5	45	28	16	2	98
15	21	19	6	3	49
16	4	9	.....	13

Grand Total....4429

Table III shows the distribution of percentages at each age according to the number of years advanced or retarded.

TABLE III.
COMPOSITE TABLE, SHOWING THE DISTRIBUTION OF MENTAL AGES FOR EACH
CHRONOLOGICAL AGE. PERCENTAGE.

Age	+4	+3	+2	+1	0	-1	-2	-3	-4	-5	-6
3	16.7	25.0	25.0	33.3	.....	.....	.....	.....	.....
4	3.2	44.5	22.2	20.6	7.9	1.6	.....	.....	.....	.....
5	2.3	14.0	42.4	31.8	6.8	1.9	0.8	.....	.....	.....
6	0.7	0.5	7.0	37.5	40.2	12.8	1.0	.....	0.2	.....	.....
7	0.2	1.1	3.9	29.4	55.5	6.9	2.5	0.4	0.2	.....	.....
8	2.9	5.6	17.0	48.7	24.3	0.8	0.3	0.3	.....	.....
9	0.9	3.5	23.4	44.0	21.8	6.2	0.2	.....	.....	.....
10	0.7	3.2	13.7	50.5	18.5	9.1	3.7	0.5	.....	.....
11	0.2	0.6	9.0	43.0	28.8	12.8	4.2	1.2	0.2	.....
12	0.9	31.6	35.3	20.2	8.0	3.0	0.9	.....
13	4.2	26.8	32.9	27.6	5.6	2.5	0.4
14	1.0	0.0	5.0	45.9	28.6	16.3	2.0	1.0
15	42.9	38.8	12.2	6.1
16	31.0	69.0	.....

The massing together of results from various workers in this manner is, of course, highly undesirable, and yet it represents probably better than the results of any one worker alone the use that has been made of the Binet-Simon tests up to the present time. It is understood that differences in methods of giving the tests and differences in method of computing mental age exist among the various workers. These composite tables of all the results available for normal children will merely serve as a basis for comparing the results obtained by different methods of diagnosing feeble-mindedness. The

tables show plainly the well-known fact that the Binet-Simon scale is much displaced at the upper and lower ends. A normal distribution

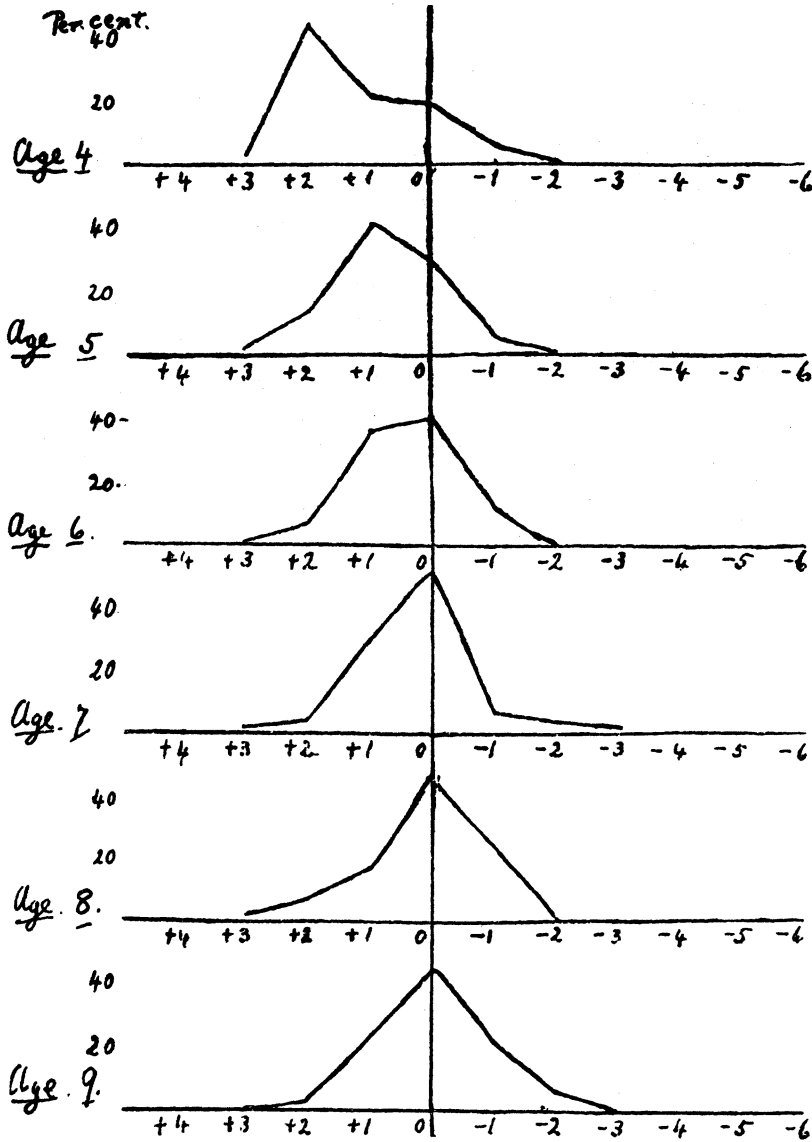


FIG. 2

at each age ought to result in the mode of the curve for each age lying at zero. That this is not the case is obvious from Figure 2.

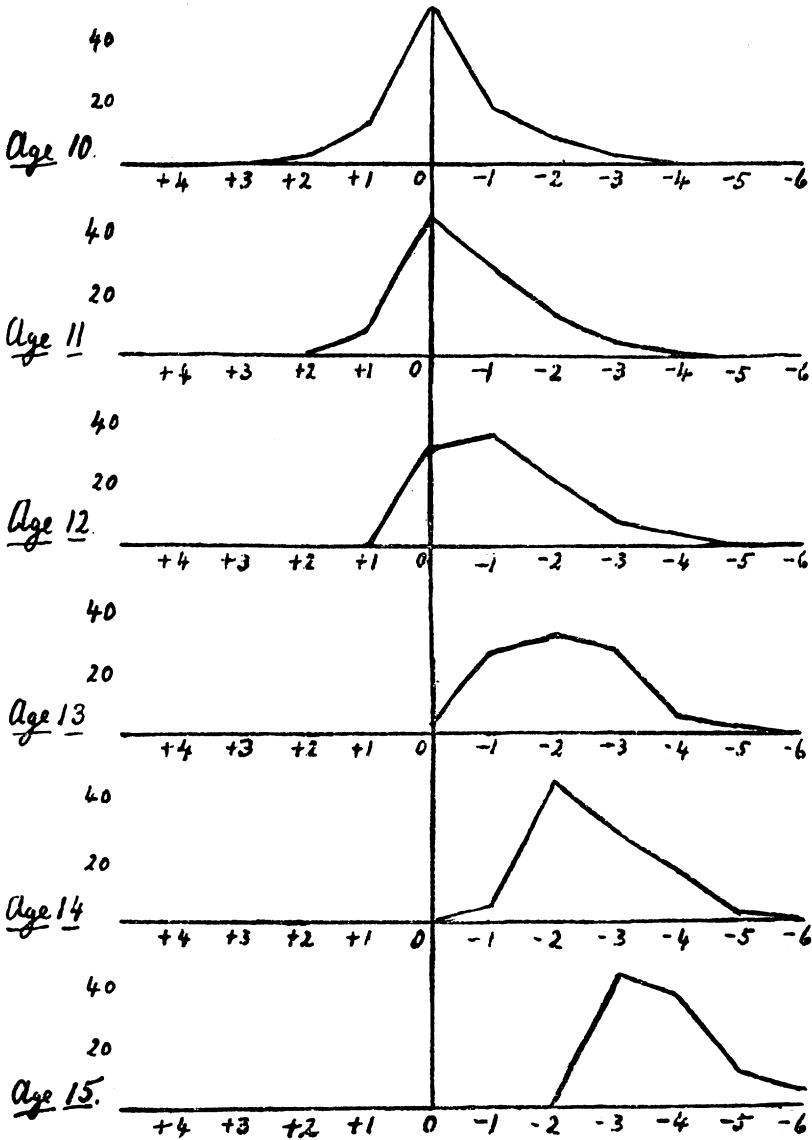


Fig. 2—Continued

The curves for ages four to sixteen inclusive, have been drawn from the percentages in Table III. The modes for ages four and five are decidedly to the left of the 0 line, which means that the normal four or five year old really tests five or six. Although the modes for ages six and seven lie on the 0 line, yet the great mass of

each curve lies to the left. Ages eight, nine and ten show a more normal distribution than any of the other ages and the modes in each case lie on the 0 line. With age eleven the shift to the right begins, which increases rapidly up to age sixteen. If our scale is to be of real diagnostic value we must take into account the distribution at each age.

Using the data in Tables II and III, we have computed in Table IV the per cent feeble-minded as diagnosed on the three and two-year basis, the four and three-year basis, and on the Intelligence Quotient basis, assuming feeble-mindedness to include all cases having an I. Q. of less than .75.

TABLE IV.
SHOWING THE PER CENT FEEBLE-MINDED AT EACH AGE AS DIAGNOSED BY 1,
3 YEAR RETARDATION ABOVE 9 AND 2 BELOW; 2, 4 YEAR RETARDATION
ABOVE 9 AND 3 BELOW; 3 AN INTELLIGENCE QUOTIENT OF LESS
THAN .75.

Age	3 and 2 Basis	4 and 3 Basis	I. Q. .75
4	1.6	0.0	1.6
5	2.7	0.8	2.2
6	1.2	0.2	0.7
7	3.1	0.6	1.6
8	1.4	0.6	0.6
9	6.4	0.2	0.05
10	4.2	0.5	2.3
11	5.6	1.4	2.5
12	11.9	3.9	3.9
13	36.1	8.5	7.1
14	47.9	19.3	11.1
15	100.0	57.1	28.0

In the tabulation of cases for Tables II and III and in the computation of retardation as required for Table IV there is probably an error impossible to estimate owing to the various ways in which the results are given by various writers. Some few writers have given the chronological and mental age for each case, but most have given summaries where either the cases are distributed according to number of years retarded or to mental age shown by the tests. In the former case it is impossible to know whether fractions of years in chronological and mental age have been taken into account, that is, whether the retardation of a specific case is arrived at by subtracting, say 7.2 chronological age and 6.4 mental age, or by merely subtracting the whole numbers 7 and 6. In the latter case where mental ages without fractions are given we have subtracted these from the chronological age. The retardation in our tables is, therefore, the difference between the mental and chronological ages, no regard being paid to fractional years in either case. This means that under 0 years retardation all cases testing between 0 and .9 of the corresponding chronological age are included, and under one-year all cases from

.9 to 0 of the year below the corresponding chronological age are included. To take a specific age, say seven, we indicate below the range in mental age for each of the columns of our table:—

	+3	+2	+1	0	-1	-2
Mental Age	10.9-10	9.9-9	8.9-8	7.9-7	6.9-6	5.9-5 and so on.

It is obvious that given the chronological age in months and the mental age with fractions the retardation as expressed by the difference would not always correspond to the amount of retardation as we have been forced to compute it for our tables.

The outstanding fact of these tables is the varying amount of feeble-mindedness from age to age. It seems incredible that there should be 0% feeble-minded at age four and that this should increase irregularly to 8.5% at age thirteen, as the four and three basis shows, or that the percentage should fluctuate up and down as the I. Q. method would indicate. This fact, although hardly stated in this way, has been felt keenly by Binet workers and it is for this reason that the old three-year basis at all ages was abandoned and the three and two-year basis adopted. This fact has also led to the introduction of the intelligence quotient. The I. Q. has been used by Terman (Note 6 *ante*) in the Stanford Revision of the Binet-Simon scale, which promises much more accurate results than the old scale. Yet even here in the data so far published we note a different percentage of feeble-minded on the .75 I. Q. basis in the three years for which the results are available. At age six we have 1% below .75, at age nine the percentage is 2 and at age thirteen the percentage is 8. This would seem to indicate a constantly increasing percentage from the lower to the higher ages, and would therefore make a diagnosis of feeble-mindedness by adhering to any one specific intelligence quotient unfeasible on the assumption that the amount of feeble-mindedness is constant at each age.

Let us examine the theory underlying the different methods of diagnosis. If we adhere to a constant amount of retardation, as in the rigid three-year retardation method, as being the criterion of feeble-mindedness at each age, then the curve of feeble-minded mentality would be at a constant distance from the curve of normal mentality from age to age as shown by Figure 3, in which the upper curve represents normal and the lower defective mentality, and where $aa^1 = bb^1$ at all ages.

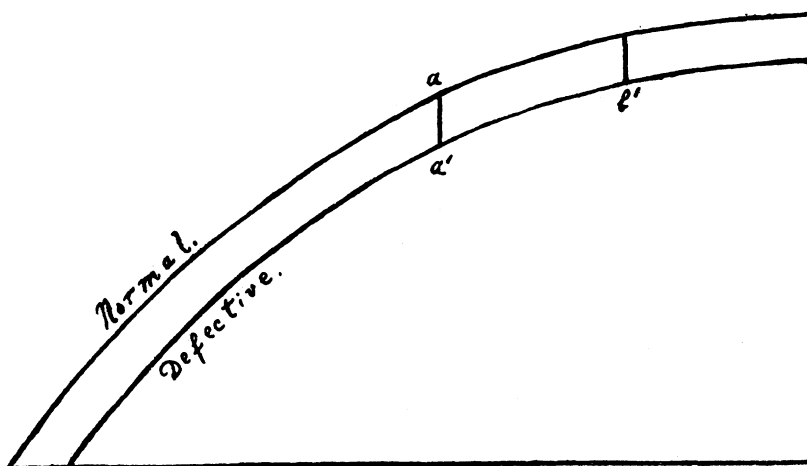


FIG. 3

Keeping strictly to the three and two-year basis of diagnosing feeble-mindedness, a curve of the type shown in Figure 4 results, in which we have to assume a more or less abrupt change in the distance between the two curves at age nine, but in which again the distance between the two curves is constant.

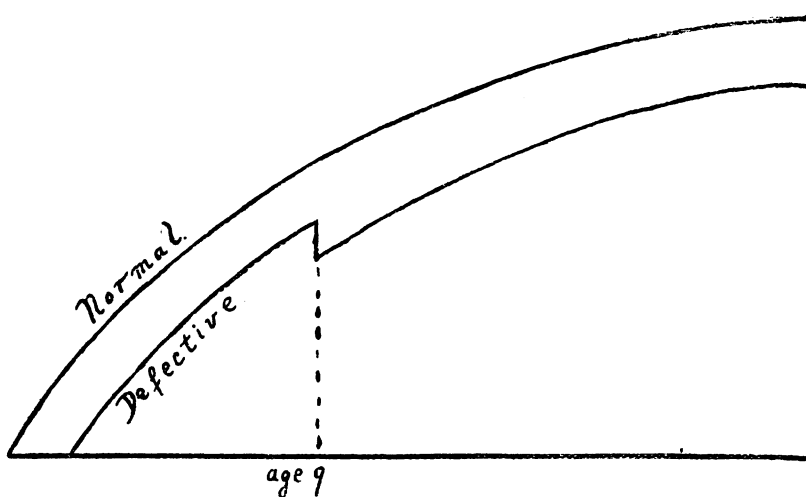


FIG. 4

The curve that most probably represents the growth of intelligence is rather of the type shown in Figure 5, in which there is an increasing difference between the curve of normal and the curve of defective mentality.

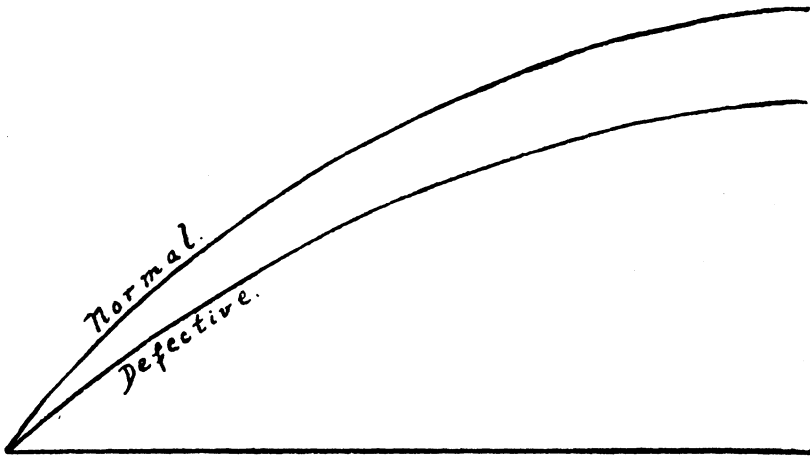


FIG. 5

There is less possibility of variation in mentality the younger the age of the group. With adults we have the whole range from a high degree of intelligence down to blank idiocy, whereas with a younger age group the highest point of mentality is necessarily far below that of the adult and therefore the range down to idiocy is consequently much smaller.

The assumption of a constant three per cent feeble-minded at each age would indicate that the growth of intelligence is somewhat as shown in Figure 5. This is borne out by the increasing amount of retardation as indicative of feeble-mindedness as we advance from the lower to the higher ages. It is this fact that the I. Q. has emphasized, but the I. Q. takes it for granted that the increase in intelligence from year to year is constant. Our method of finding the upper limit of feeble-mindedness on the three per cent basis with the actual results that have so far been published would hardly bear this out. Theoretically it would be simpler to suppose that the difference between normal and defective mentality from age to age increases uniformly, but this may not be the case and if it is not the case, then the I. Q. method would lead to inequalities in the estimates of feeble-mindedness at certain ages, allotting here too many and there too few, as we have seen in Table IV. We are not yet ready to presuppose that the curves of mental development are absolutely regular as indicated on Figure 5. The curves may be irregular and if they are we dare not suppose that these irregularities in the curves for normal and defective mentality are bound to occur at the same chronological year. If there are irregularities, the I. Q. method would have them occurring at the same place on each curve somewhat as in

Figure 6, where the distance between the two curves increases by a constant increment, whereas the real picture may be as in Figure 7. In this last figure the distances between the two curves are not supposed to increase from age to age by constant increments. Now this seems to be the case as far as we can judge from the available data.

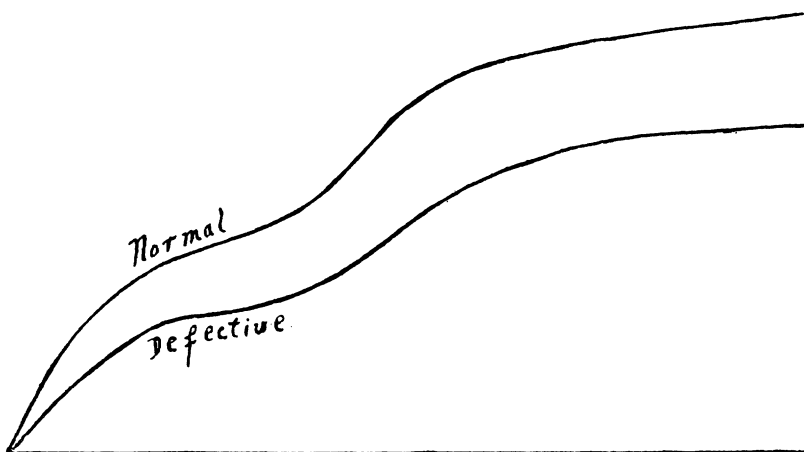


FIG. 6

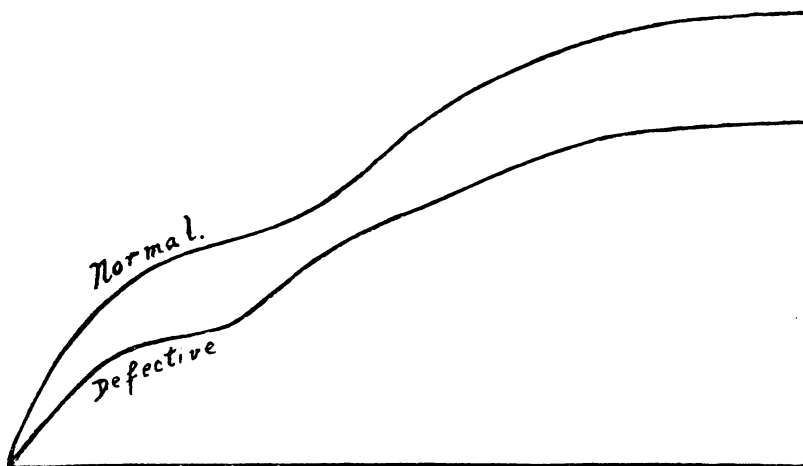


FIG. 7

Table V gives the limits of each division of our theoretical curve of distribution. Assuming the divisions of feeble-minded, backward, normal, bright, very bright to be 3, 22, 50, 22, 3 per cent respectively, we have computed from Tables II or III the points on the Binet-Simon scale which correspond to these divisions. This

computation is not supposed to be absolutely accurate, because it has been derived from a heterogeneous mass of data from different workers, but it seems to us to indicate the method by which the diagnostic value of any scale must ultimately be derived. Our method in working

TABLE V.

SHOWING THE RANGE IN MENTAL AGE ON THE BINET-SIMON SCALE FOR THE FIVE GROUPS, FOR EACH CHRONOLOGICAL AGE.

Age	Lowest 3% Feeble-minded	Lower 22% Backward	Middle 50% Normal	Upper 22% Bright	Highest 3% Very Bright
3	2.1 and below	2.1 to 2.75	2.75 to 4.7	4.7 to 5.8	5.8 and above
4	3.2 and below	3.2 to 4.2	4.2 to 6.5	6.5 to 7.0	7.0 and above
5	4.0 and below	4.0 to 5.5	5.5 to 6.8	6.8 to 7.9	7.9 and above
6	5.1 and below	5.1 to 6.3	6.3 to 7.6	7.6 to 8.8	8.8 and above
7	5.8 and below	5.8 to 7.25	7.25 to 8.3	8.3 to 9.5	9.5 and above
8	7.1 and below	7.1 to 8.0	8.0 to 9.0	9.0 to 11.0	11.0 and above
9	7.4 and below	7.4 to 8.95	8.95 to 10.2	10.2 to 11.4	11.4 and above
10	7.7 and below	7.7 to 9.6	9.6 to 10.85	10.85 to 12.3	12.3 and above
11	8.4 and below	8.4 to 10.2	10.2 to 11.7	11.7 to 12.75	12.75 and above
12	8.7 and below	8.7 to 10.6	10.6 to 12.2	12.2 to 12.95	12.95 and above
13	9.0 and below	9.0 to 10.6	10.6 to 12.2	12.2 to 13.3	13.3 and above
14	10.0 and below	10.0 to 11.2	11.2 to 12.6	12.6 to 13.4	13.4 and above
15	9.5 and below	9.5 to 11.15	11.15 to 12.4	12.4 to 12.9	12.9 and above

out the limits for each division has been to find out roughly where the 3%, 25%, 75% and 97% line would be drawn, assuming an even distribution of cases over each year retarded or advanced as given in Tables II or III. The distribution would not be even, on the assumption of a bell-shaped curve, but our computation is adequate for the purpose of demonstrating the method, and certainly accurate enough in view of the data with which we are dealing. Only with the accumulation of sufficient data expressed in fractions of mental age could the limiting points for each of the groups be arrived at with greater exactitude. The accumulation of results might lead from time to time to a revision of these points on the scale and the larger and more unselected the group of individuals tested, the more accurate would the limiting points on the scale become. It would be a self-perfecting method for arriving at the diagnostic value of our intelligence scales.

Having now found the limits of feeble-mindedness on our three per cent hypothesis, we may turn to a comparison of this with I. Q. method in regard to the amount of retardation at each age, and test our assumption of the curve of intelligence as shown in Figure 7.

Table VI gives the amount of retardation of the feeble-minded group expressed in years on the three per cent hypothesis, as contrasted with the amount of retardation demanded by the I. Q. .75 standard.

TABLE VI.
SHOWING THE AMOUNT OF RETARDATION OF F. M. GROUP EXPRESSED IN
YEARS ON 1, THE HYPOTHESIS OF 3% F. M.; 2, THE INTELLIGENCE
QUOTIENT METHOD, REGARDING BELOW .75 AS F. M.

Age	3% Hypothesis	I. Q. .75
3	1.4	1.25
4	1.3	1.50
5	1.5	1.75
6	1.4	2.00
7	1.7	2.25
8	1.4	2.50
9	2.1	2.75
10	2.8	3.00
11	3.1	3.25
12	3.8	3.50
13	4.5	3.75
14	4.0	4.00
15	4.5	4.25

If the data with which we have been forced to deal are accurate, the table would seem to indicate that the retardation from year to year does not increase uniformly as the I. Q. method would demand. It may be, of course, that this is due to the data with which we have been working. One obvious error seems to occur at age fifteen, where the upper limit for feeble-mindedness is 9.5 with a retardation of 4.5, whereas at age fourteen it is ten years with a retardation of 4 years. This is probably owing to the well-known deficiency of the Binet-Simon scale at the upper ages and to the poorer selection of fifteen year old children. Theoretically it would be easier to assume the I. Q. method, but it seems to us unsafe to do so until we actually find the lowest three per cent at each age coinciding with the line of demarcation as drawn by that method.

The Yerkes-Bridges Point Scale. The revised and modified form of the Binet-Simon scale as proposed by Yerkes, Bridges and Hardwick may be subjected to the same analysis from the point of view of our hypothesis. The scale is put forward as being more accurate and this would lead us to infer that the diagnosis of feeble-mindedness as made on this scale would approximate more closely the expectation of feeble-mindedness on our hypothesis. It is to be noted that nowhere in the book is any definite limit set for feeble-mindedness. Many inferences seem possible from this lack of any definite statement. It may be that the author or authors did not feel warranted in setting any specific limits for feeble-mindedness in view of the uncertain opinion at present prevailing. It may be that the customary three and two years retardation or below a mental age of twelve for adults is taken as a matter of course, and that the readjustment of the old tests and the addition of new ones is supposed

to have corrected the inaccuracies in diagnosis resulting from the old Binet-Simon scale. Some color is lent to this supposition by the work of Rossy ¹⁶ who uses "the below twelve-year basis" as diagnostic of feeble-mindedness in adults, the mental age being arrived at by the Yerkes-Bridges scale. He says, "No subject is diagnosed feeble-minded unless he grades below twelve years mental age by the Point Scale."

This lack of definiteness on the authors' part has lead others to take a specific number of points as diagnostic and this seems to grow out of a suggestion by the authors (Note 5 *ante*), (p. 93). Seventy-five points may be regarded as the upper limit of feeble-mindedness for adolescents and adults. This is the view taken by Woolley (Note 15 *ante*), who considers adolescents falling below 75 points as mentally defective, and those between 75 and 85 as being borderline cases.

Another interpretation has been taken by Haines¹⁷, who uses as the limit for feeble-mindedness 25 per cent below the normal for the individual's chronological age. This is, of course, the I. Q. method using points instead of years. Applying the three and two-year retardation standard as diagnostic of feeble-mindedness to the results as given by Yerkes (computed from Table 3, p. 52 and Table 8, p. 64. Note 5 *ante*), we have the number and per cent feeble-minded at each age as shown in Table VII. Just as with the Binet-Simon scale, we see here the varying amount of feeble-mindedness at each

TABLE VII.
SHOWING THE NUMBER AND PER CENT FEEBLE-MINDED BY 1, 3 YEAR
RETARDATION ABOVE 9 AND 2 BELOW; 2, 4 YEAR RETARDATION
ABOVE 9 AND 3 BELOW.

Age	3 and 2 Basis				4 and 3 Basis			
	English		Non-English		English		Non-English	
	No.	%	No.	%	No.	%	No.	%
6	4	7.3	0	0				
7	4	8.4	3	11.9	2	4.2	0	0
8	5	10.6	2	14.2	2	4.2	0	0
9	1	2.3	1	3.2	1	2.3	1	3.2
10	0	0	0	0	0	0	0	0
11	1	1.8	0	0	0	0	0	0
12	2	5.0	3	15.0	0	0	1	5.0
13	2	4.6	3	17.4	2	4.6	1	5.8
14	3	8.1	2	13.3	2	5.4	1	6.6
15	3	18.7	5	55.5	1	6.2	3	33.3
Totals	25	4.6	19	9.8	10	2.6	7	3.9
Total of both groups,	44 or 7.0%				17 or 3.05%			

¹⁶Rossy, C. S. First Note on a Psychological Study of the Criminals at the Massachusetts State Prison. Bulletin No. 13 of the Mass. State Board of Insanity. September, 1913, p. 12.

¹⁷Haines, Thomas H. Mental Examination of Delinquent Boys and Girls. The Illinois Medical Journal. October, 1915.

age, ranging from 8.1 to 0 per cent, disregarding age 15, with English-speaking children. With non-English speaking children the fluctuation from age to age is still greater, from 17.4 to 0 per cent. This gives a total percentage of 4.6 for English-speaking and 9.8 for non-English speaking who are feeble-minded, and a total of the two groups combined of seven per cent feeble-minded.

The distribution of feeble-minded on the four and three-year retardation basis is also given in Table VII. This gives a total percentage of 3.05 feeble-minded for both groups and so corresponds in a way to our hypothesis, but the fluctuations of the percentage feeble-minded from age to age are again too great and indicative of a faulty method of diagnosis. Turning to the I. Q. method as used by Haines (Note 17 *ante*), we show in Table VIII the number of points 25% below the norm for each age or the I. Q. of .75 and the number and percentage of cases falling below this standard. This table is computed from the norms as given by Yerkes (Table 3, p. 52

TABLE VIII.
SHOWING THE SCORE ON YERKES SCALE AT THE I. Q. .75 AT EACH AGE,
NUMBER AND PER CENT OF CASES FALLING BELOW THIS SCORE
AT EACH AGE.

Age	I. Q. .75	No. Below	Per Cent Below
5	16.5	7	18.0
6	21.75	11	15.5
7	25.5	13	17.8
8	29.25	9	14.7
9	39.0	7	9.5
10	44.25	9	11.8
11	48.0	7	8.9
12	55.5	5	8.3
13	55.5	4	6.7
14	58.5	2	3.8
15	57.75	3	12.0
Total	452.25	77	11.5

and Table 8, p. 64. Note 5 *ante*). Here again we see the percentages of feeble-mindedness varying from 3.8 to 18, and giving a percentage of 11.5 for the whole group.

Assuming the normal curve of distribution and the five divisions, the various limits for feeble-mindedness, backwardness, normality, etc., on the Yerkes-Bridges scale have been computed by us with the available data in the same way as these limits were computed for the Binet-Simon scale. These points are shown in Table IX. Here again the accumulation of more data on unselected groups would probably alter the limits somewhat, but the additional results would make more certain the limiting points and add to the diagnostic value of the scale. Just as the addition of more unselected cases will

TABLE IX.

SHOWING THE RANGE IN SCORE ON THE YERKES-BRIDGES SCALE FOR THE FIVE GROUPS FOR EACH CHRONOLOGICAL AGE.

Age	Lowest 3% Feeble-minded	Lower 22% Backward	Middle 50% Normal	Upper 22% Bright	Highest 3% Very Bright
5	10 or 11 & below	11 to 17	17 to 26	26 to 34	34 and above
6	13.5 and below	13.5 to 23	23 to 34	34 to 43	43 and above
7	17 and below	17 to 28	28 to 40	40 to 47.5	47.5 and above
8	19.5 and below	19.5 to 34.2	34.2 to 47	47 to 57	57 and above
9	23 and below	23 to 44	44 to 60.5	60.5 to 70.8	70.8 and above
10	39.3 and below	39.3 to 54	54 to 67	67 to 79.7	79.7 and above
11	41.4 and below	41.4 to 58	58 to 71	71 to 84.6	84.6 and above
12	42.6 and below	42.6 to 64	64 to 85	85 to 92.8	92.8 and above
13	44.4 and below	44.4 to 70	70 to 86	86 to 92.4	92.4 and above
14	48.8 and below	48.8 to 75	75 to 87	87 to 92.4	92.4 and above
15	48 and below	48 to 68	68 to 87.6	87.6 to 96.2	96.2 and above

tend to correct the norms for each age of the Yerkes-Bridges scale, so the limiting points for each group as computed by us could be corrected from time to time.

Application of the Method to Tests of Delinquents. Although the limiting points on the Binet-Simon and Yerkes-Bridges scales for the five groups suggested by our hypothesis cannot lay any claim to finality, in view of the comparatively small number of cases at each age in reference to such a hypothesis, and in view of the different methods adopted by different workers, we have nevertheless used these limiting points (Tables V and IX) to diagnose groups of delinquents and to compare the diagnoses on this basis with the diagnoses arrived at by seven different authors. The data have been taken from studies of the mentality of delinquents by Kohs¹⁸, Hickman¹⁹, Jennings and Hallock²⁰, Pintner²¹, Renz²², Crane²³, and Haines (Note 17 *ante*). All of these studies with the exception of the last are based upon the Binet-Simon scale alone. In Haines' study we have the mental level for each child as determined both by the Binet-Simon and the Yerkes-Bridges scales. The actual result for each case is given and this adds decidedly to the value of the study. There are other estimates of the percentage of feeble-mindedness among delin-

¹⁸Kohs, S. C. The Practicability of the Binet Scale and the Question of the Borderline Case. Publications of the Research Department, Chicago House of Correction. Bulletin No. 3, November, 1915.

¹⁹Doll, E. A. Supplementary Analysis of H. B. Hickman's Study of Delinquents. Training School Bulletin. Vol. XI, 1915, p. 165.

²⁰Jennings, H. M. and Hallock, R. L. Binet-Simon Tests at the George Junior Republic. J. of Ed. Psych. Vol. IV, 1913, p. 471.

²¹Pintner, Rudolf. One Hundred Delinquents Tested by the Binet Scale. Ped. Sem. Vol. XXI, 1914, p. 523.

²²Renz, Emilie. A Study of the Intelligence of Delinquents and the Eugenic Significance of Mental Defect. M. A. Thesis. Ohio State University, 1913.

²³Report of the Commission to investigate the Extent of Feeble-mindedness, Epilepsy and Insanity in Michigan, 1915.

quents that are not available for this method, because of the fact that the distribution by mental age is not given. It would have been interesting to take the results of such writers as Faulkner or Hickson, whose estimates of feeble-mindedness among delinquents are unbelievably and absurdly high. The former found 74 per cent feeble-minded among 480 men in the Kansas State Penitentiary, and the latter 84 per cent morons and 8 per cent borderline out of 245 boys in the Chicago Psychopathic Laboratory.

TABLE X.
SHOWING THE PERCENTAGES OF CASES FEEBLE-MINDED, BACKWARD OR
NORMAL, AS ESTIMATED BY SEVEN DIFFERENT AUTHORS AND AS
ESTIMATED BY THE 3% HYPOTHESIS.

NAME OF AUTHORS	Number of Cases	Estimate of Authors		Estimate on 3% Hypothesis			Difference of F. M. Estimates
		F. M.	Back- ward	Normal	F. M.	Back- ward	
Jennings and Hallock....	26	34.6	15.4	49.9	11.5	11.5	23.1
Hickman (Doll).....	208	72.5	15.7	11.8	39.4	32.7	33.1
Kohs.....	335	49.9	29.8	20.3	30.2	43.9	19.7
Pintner.....	100	46.0	21.0	33.0	19.0	54.0	27.0
Renz.....	100	58.0	.....	42.0	33.0	47.0	25.0
Crane.....	1187	27.5	.....	72.5	11.3	23.8	16.2
Haines (Yerkes Scale)...	880	30.2	12.1	57.7	6.6	56.0	23.6
Haines (Binet Scale).....	.....	.....	.....	.....	26.4	37.0	3.8
Totals.....	2836	.....	.....	.....	21.3	32.7	46.0

In Table X we give the percentages of feeble-minded, backward and normal cases as arrived at by the respective authors and also as determined by the diagnosis according to the limits deduced from our three per cent hypothesis. The differences between these two estimates of feeble-mindedness are given in the last column. In every case it will be noted that the percentage feeble-minded is lower by our hypothesis than by whatever method the author may have adopted. This may lead one to some such general conclusion as this, that at present we are subjecting our delinquents to much more severe standards of intelligence than we apply to non-delinquents, or that if the percentage of feeble-mindedness among delinquents is such as the studies in question give, then the percentage of feeble-minded among non-delinquents is much higher than we customarily suppose to be the case. In some studies the discrepancy between the two estimates is very large, as in the case of Hickman, Jennings and Hallock, Pintner and Renz. The distribution of Crane's cases is interesting. We have worked these out for our five divisions and as there are 1,187 cases, we have a fairly large number with which to deal. Diagnosed by our method we have the following distribution:—

F. M.—11.3%, Backward—23.8%, Normal—44.0%, Bright—16.9%, Very Bright—4.1%. This is a fairly normal distribution, giving about 50% in the middle group, but skewed to one side as we should expect with a group of delinquents.

In the case of Haines' data, we have the possibility of a comparison of percentages of feeble-mindedness derived from the Binet-Simon and Yerkes-Bridges scales. Our percentages as derived from the Binet-Simon scale are much higher than those derived from the Yerkes-Bridges scale, and it is interesting to note that the percentages of Haines as derived from the Yerkes agree fairly well with our figures derived from the Binet, but disagree radically with our percentages as derived from the Yerkes scale. This seems to point to some radical difference between the two scales, which it is not the purpose of this article to discuss. It is however worth noting that by applying Haines' method of diagnosis to the unselected children of Yerkes-Bridges, we arrived above at a percentage of 11.5 feeble-minded (see Table VIII). If there are 30.2% feeble-minded among the 880 delinquents, then there are on the same basis 11.5% feeble-minded among the 670 presumably non-delinquent school children tested by Yerkes and Bridges. A percentage of 11.5 would be admitted as a very high figure for feeble-mindedness among unselected school children. On the hypothesis of three per cent feeble-minded among the school children, we arrive at 6.6% feeble-minded among the delinquents, or nearly twice as many. This is a very low estimate in comparison with the usual opinions concerning feeble-mindedness among delinquents and we would not maintain that it is correct. We do not believe that the number of cases tested by Yerkes and Bridges is sufficient, and this refers particularly to the higher ages, to ensure the reliability of the limiting points which we have computed. Furthermore owing to the lack of cases above age fourteen, we have applied the fourteen year old limits to all cases above age fourteen and these may be too low for individuals above age fourteen.

Conclusion. We offer these diagnostic tables for the Binet-Simon and the Yerkes-Bridges scales merely as indicative of a method which might successfully be followed out in order to increase the diagnostic value of intelligence scales. This mode of procedure is, of course, dependent entirely upon the acceptance of some hypothesis in regard to the division of individuals into groups and the agreement of some percentage to denote the number of individuals in each group. In regard to feeble-mindedness in particular, we believe that much would be gained by the acceptance of a one, two, three or four per cent hypothesis.

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